

DOE Electricity Advisory Committee Energy Storage Session Introduction **Overview of Energy Storage and Key Trends**

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The Economist

MARCH 9TH - 15TH 2013

Economist.com

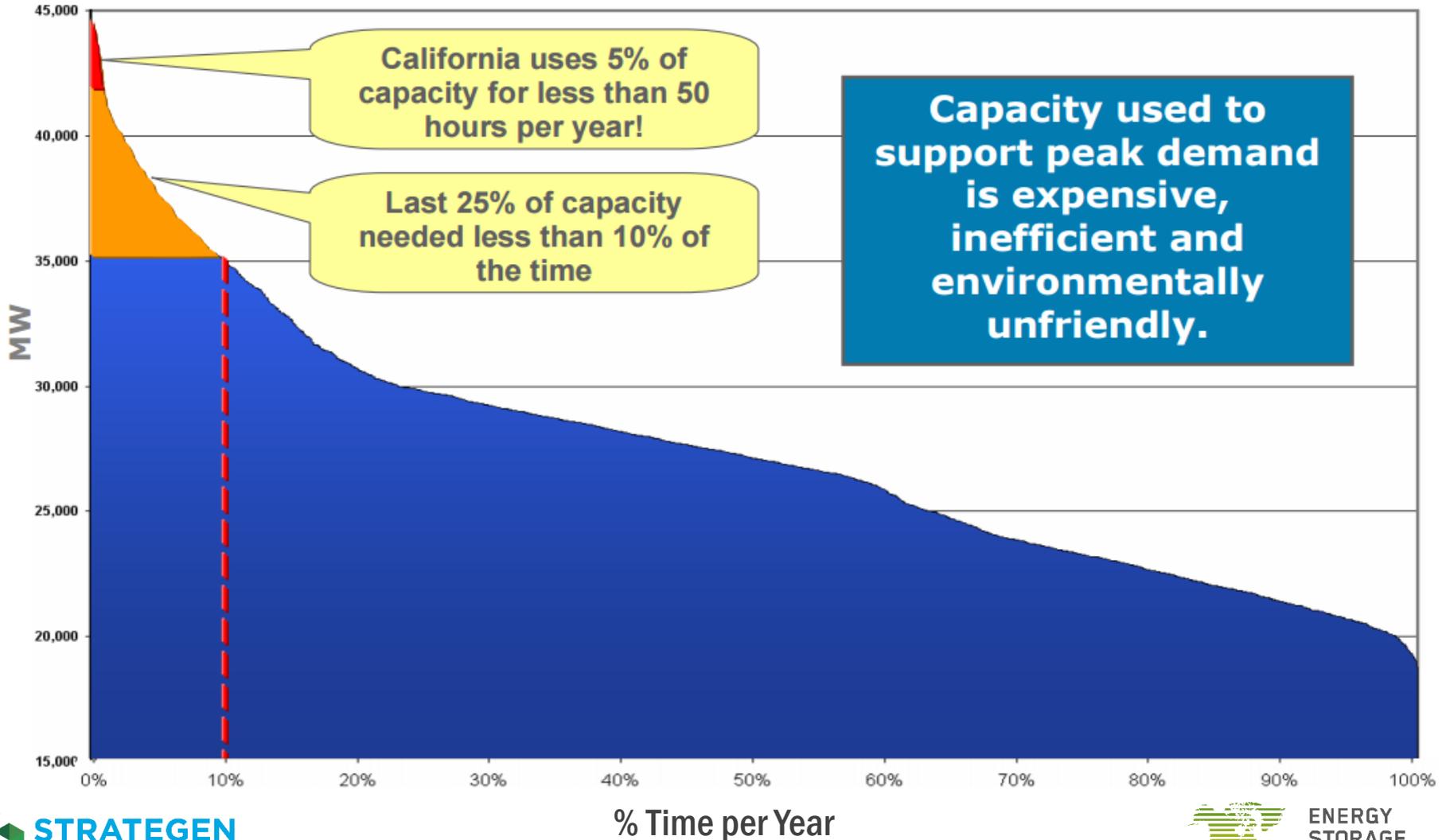
Hugo Chávez's rotten legacy
Is the stockmarket right?
Management tips for the Vatican
Getting Britain to grow
The comet that could hit Mars

The sharing economy



Big opportunity for better asset utilization in the power sector

System Load Duration Curve



Source: PG&E Demand Response Programs: An Overview presentation

In the aftermath of Hurricane Sandy, residents of New York City housing projects congregate around a generator to power their mobile phones after days without electricity.



Source: Clean Energy Group *Resilience For Free*, October 2015

Many type of storage are available today

Electro-Chemical



*(Flow battery / Lithium Ion /
Other Chemistries)*

Thermal



(Ice / Molten Salt)

Mechanical



(Flywheel)

Bulk Gravitational



(Pumped Hydro)

Bulk Mechanical



(Compressed Air)

Transportation

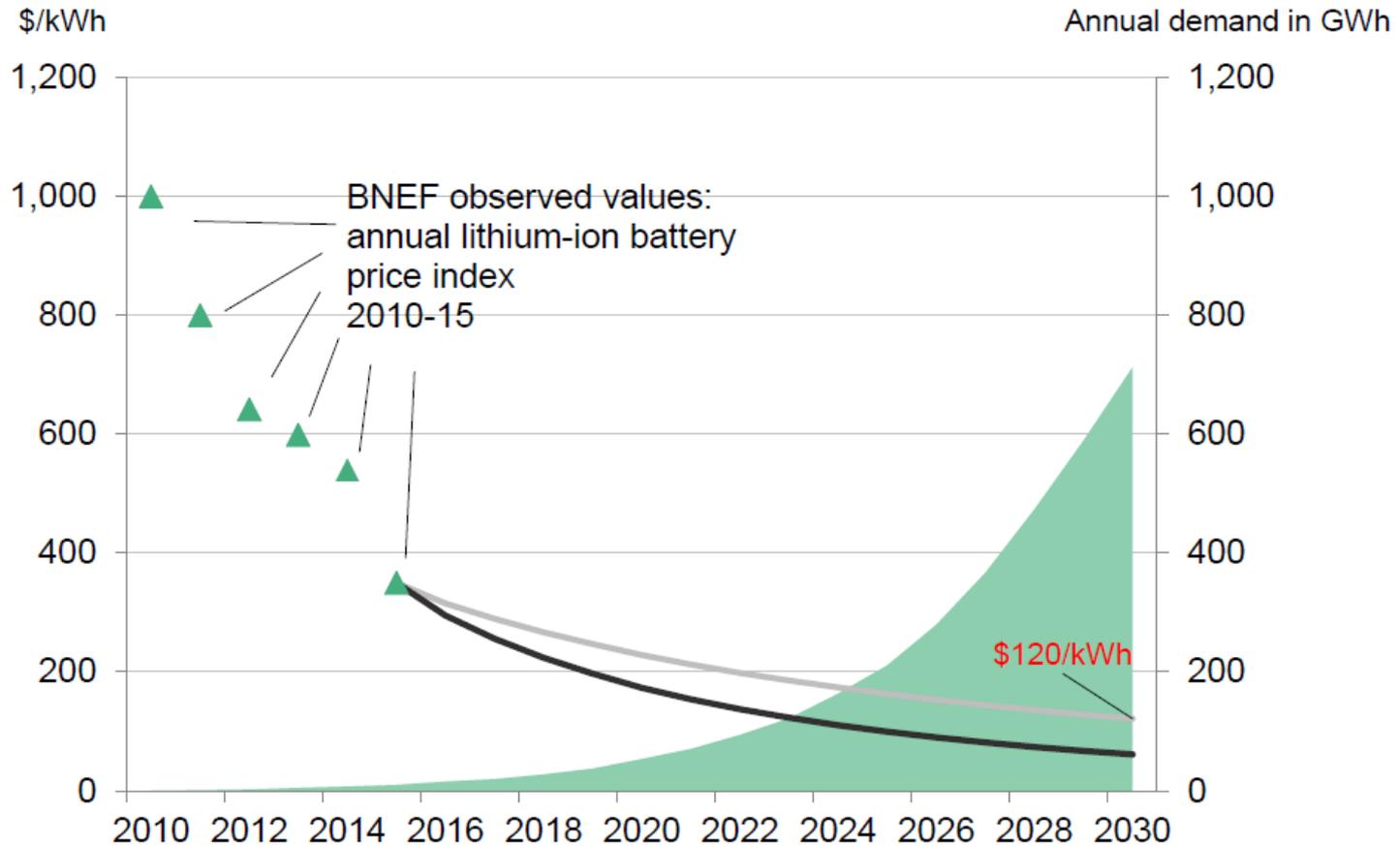


(Electric Vehicles)



Mensfitness.com

Prices are rapidly falling as demand increases



How Austin Energy Aims to Reach Solar-Plus-Storage Integration at 14 Cents per Kilowatt-Hour



A \$4.3 million project links Tesla batteries, demand response and 1Energy's software in the quest for a cost-effective battery-solar-grid combination.

Greentech Media, March 21, 2016



BRIEF

Hawaii co-op signs deal for solar+storage project at 11¢/kWh

UtilityDive, January 10, 2017



FEATURE

How can Tucson Electric get solar + storage for 4.5¢/kWh?

Subsidies and aggressive pricing assumptions are key to the stunning Arizona PPA price, analysts say

UtilityDive, May 30, 2017



Power System Gamechanger:
ENERGY STORAGE



Energy storage is like bacon



It goes well with everything!

Is energy storage cost effective?



EAC Energy Storage Session Objectives

Objectives

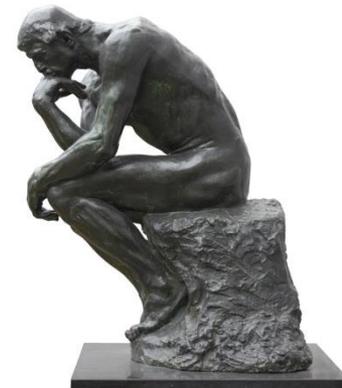
1. Learn about grid vulnerabilities and recent progress in energy storage deployments
2. Identify role of storage in achieving a more efficient, resilient grid
3. Identify gaps between status quo and desired commercial end state for key applications
4. Identify solutions and actions for the federal government to help close the gaps.

Key Working Session Focus Areas

1. Power Sector Vulnerabilities
2. Advances in Energy Storage for System Reliability and Resiliency
3. Storage and Microgrids
4. Regional Resiliency and Security with Bulk Storage

Questions to Consider Throughout the Day

- » How can energy storage support a **modern, reliable and resilient 21st century power grid** for the US?
- » What are the **grid reliability and resiliency challenges** that storage maybe able to assist with?
- » What **future energy storage capabilities** are necessary ?
- » What are the **medium and long term challenges to realizing these capabilities?**
- » **What can the federal government (DOE and other agencies) do** to help address these challenges?
- » What did I **learn** that I was not aware of before?



Ground Rules

- » **No such thing as a dumb question!** Stepping outside your normal viewpoint is encouraged.
- » EAC's resulting public report not attribute a specific quote to anyone without your prior written approval. Feel free to speak your mind and **generate ideas.**
- » **One speaker at a time – please stay on topic**
- » **Importance of keeping to schedule**

Who is in the room? Quick introductions ...

- » Name
- » Title/role/Organization
- » One question regarding energy storage that you would like to have answered today

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www.strategen.com

www.esnaexpo.com

- California Energy Storage Alliance (CESA)
 - 501(c)(6) founded in January 2009
 - 70+ member companies
 - Active at CPUC, CAISO and State Legislature
- Strategen Consulting
 - Strategic advisory in clean energy since 2005
 - Government, utility and corporate clientele
- Energy Storage North America (ESNA)
 - Largest storage conference in North America
 - 42 countries in attendance, 100+ exhibitors

